

CLAIMS

1. Biochip support comprising a substrate (5,25) supporting at least one porous layer of material on a first face, the said layer being designed to fix biological molecules onto the said layer and in the volume of this layer, the said support
5 being characterised in that the said layer is a thin optical layer (9, 29) of material prepared by the sol-gel method and for which the refraction index is less than the refraction index of the substrate (5,25).
2. Biochip support according to claim 1, characterised in that it also comprises at
10 least one optical layer (9,29) of material prepared by a sol-gel method supported by a second face of the substrate(5,25) opposite the first face, the said thin layer supported by the second face having a refraction index lower than the refraction index of the substrate.
- 15 3. Biochip support according to claim 1, characterised in that it comprises a stack (28) of dielectric thin layers forming a Bragg mirror inserted between the substrate (25) and the thin layer (29) of material prepared by the sol-gel method.
- 20 4. Biochip support according to any one of the previous claims, characterised in that the substrate (5,25) is formed from a material chosen from among the group comprising glasses, polymers and semiconductors.
- 25 5. Biochip support according to either claim 1 or 2, characterised in that the material prepared by the sol-gel method has a purely inorganic composition.
6. Biochip support according to either claim 1 or 2, characterised in that the material prepared by the sol-gel method is composed of an inorganic fraction and an organic fraction.

7. Biochip support according to claim 6, characterised in that the inorganic fraction is larger than the organic fraction.

8. Biochip support according to either claim 6 or 7, characterised in that the inorganic fraction confers its cohesion to the sol-gel material.

9. Biochip support according to either claim 5 or 6, characterised in that the said material comprises at least one compound chosen from among:

- an oxide $MxOy$, where M is chosen from among the group composed of Si, Al, Zr, Ti and Ta,

- an $-M-O-M'$ - type compound, where M and M' are chosen from among the group composed of Si, Al, Zr, Ti and Ta.

10. Biochip support according to the previous claim, characterised in that when the material prepared by the sol-gel method comprises an $-M-O-M'$ - type compound, M is Si and M' is Zr or Ti.

11. Biochip support according to claim 6, characterised in that the organic fraction is a polymer, the said polymer remaining free or being weakly bonded to the elements forming the inorganic fraction.

12. Biochip support according to claim 6, characterised in that the organic fraction is the result of incorporating a silane $X-R_2-Si(OR_1)_n$ into the inorganic fraction.

13. Biochip support according to the previous claim, characterised in that:

- R1 is chosen from among the group comprising $-CH_3$, $-C_2H_5$, nPr, iPr or tBu,

- R2 is an aliphatic chain with length $p-CH_2$, preferably without an ether function $-CH_2-O-CH_2-$, where p is between 2 and 10,

- X is a reactive terminal organic group chosen from among the group comprising -OH, -COOH, -CH=O, -NH₂, -Cl, -epoxy, -glycidoxy, -CH=CH₂, -acryl or -methacryl.

5 **14.** Biochip support according to any one of the previous claims, characterised in that the said thin layer (9,29) of material prepared by the sol-gel method has pores with size of between 5 nm and 100 nm, and a total porosity of between 1% and 50%.

10 **15.** Process for grafting biological molecules or biomolecules onto and into the thin layer (9,29) of material prepared by the sol-gel method on the first face of the biochip support (5,25) according to any one of claims 1 to 14, characterised in that it comprises the following steps:

- a sol is prepared that will provide the sol-gel material,
- 15 - biomolecules are incorporated into the material during its preparation,
- biomolecules are grafted into the material during its preparation,
- a thin layer of the said sol is deposited on the first face of the substrate,
- the thin layer of sol-gel material is obtained starting from the thin layer of sol.

20 **16.** Grafting process according to the previous claim, characterised in that the biomolecules incorporated into the material during its preparation are silanised biomolecules so that they can be grafted.

25 **17.** Grafting process according to the previous claim, characterised in that biomolecules are incorporated into the said thin layer by diffusion when it is in the form of a dry gel.

30 **18.** Grafting process according to claim 16, characterised in that biomolecules are incorporated into the said thin layer when it is in the form of a wet gel, the biomolecules being grafted while the gel is drying.

19. Grafting process according to claim 16, characterised in that biomolecules are incorporated to the sol-gel material when it is in the form of sol, biomolecule grafting being made in the sol before deposition of the thin layer in the liquid state.

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20. Grafting process according to claim 15, characterised in that the preparation step of the sol includes a functionalisation step to obtain a functionalised sol-gel material for grafting biomolecules after they have been incorporated in the thin layer.

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21. Grafting process according to the previous claim, characterised in that the biomolecules are incorporated into the thin layer when the thin layer is in the form of a dry gel.

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22. Grafting process according to claim 20, characterised in that the biomolecules are incorporated into the thin layer when the thin layer is in the form of a wet gel.

23. Grafting process according to claim 20, characterised in that the biomolecules are incorporated in the sol-gel material when the material is in sol form, the biomolecules being grafted in the sol before deposition of the thin layer.

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24. Grafting process according to claim 20, characterised in that the biomolecules are also functionalised, and are then incorporated and grafted in the sol before the sol is deposited in a thin layer.

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25. Grafting process according to any one of claims 15 to 24, characterised in that it also comprises a step for structuring the thin layer of sol-gel material to obtain a network of pads or wells over all or part of the biochip support.

26. Grafting process according to the previous claim, characterised in that the said pads or wells have a characteristic dimension of between 10 and 200 micrometers, and are at a spacing of 50 to 200 micrometers.

- 5 **27.** Process according to claim 25, characterised in that the network of pads or wells is made using at least one of the techniques chosen from among etching, peeling, micro-machining of the layer of material prepared by the sol-gel method or by direct deposition of a structured layer of material prepared by the sol-gel method by local micro-distributions.